

FHWA National Freight Fluidity Monitoring Program

Display of Supply Chain Performance Data
TRB Innovations in Freight Data Workshop
Irvine, CA
April, 2019



FHWA Freight Fluidity Supply Chain Monitoring: Nat'l Program Design


Issues	Approaches
What we are measuring?	Travel time, travel time reliability, transportation cost Domestic movements – truck, rail, air, water Supply-chains (end-to-end across modes) and component segments
How much are we measuring?	Representative sample of critical US supply chains “Dow Jones Index” of key infrastructure, based on actual industries
How are index supply chains being chosen?	Selected for coverage of primary economic sectors and high-growth sectors Use of all modes, coverage of US regions Short and long-haul moves, domestic/cross-border/global supply chains
How is data being collected?	Target industries identified and recruited Industries tell us their primary supply chain (commodity/mode/O-D) patterns <ul style="list-style-type: none"> • <u>No exchange of confidential information</u> Project team assembles data to tabulate metrics for supply chain patterns <ul style="list-style-type: none"> • <u>Real data, not a model, not a scenario or forecasting tool</u> • Supply chain level, not regional/area level (like FAF or Transearch) • Public and private sources have been identified
What are the outputs?	Initial “National Fluidity <i>Monitoring</i> Dashboard” with continuous quarterly updates

FHWA Freight Fluidity Tool -- Overview

Goal: a database and visualization/mapping tool to track the cost (price of service), reliability, and travel time for multimodal freight movement, across selected representative national supply chains, on a quarterly basis

Primary Data Sources	Information Obtained	Metrics Developed by Team
24 leading US companies reflecting major freight-dependent industry sectors	Descriptions of representative supply chains – goods, modes, O/D pairs – not confidential	“Wiring Diagrams” of key trips Database rows describing trips Slots for performance metrics
NPMRDS	Highway link speeds	Truck metrics for O/D trips: median & mean speed, 95% travel time, Travel Time Index, Planning Time Index
Chainalytics	Commercial data on truck and rail IMX shipment prices	Truck & IMX metrics for O/D trips: cost per move, cost per mile
TransCore	Commercial data on rail travel times, IMX and carload	Rail metrics for O/D trips: median & mean speed, 95% travel time, Planning Time Index
STB Waybill / FRA	Confidential rail carload costs	[in progress]
US Army Corps of Engineers	Waterborne shipping costs and navigation system time/delay	[in progress]

FHWA Fluidity Tool -- Software Platforms

- Two integrated platforms, both from existing suite of FHWA freight measurements tools:
 - Tableau database management, analysis and visualization platform 
 - FHWA/HOFM GIS data visualization tools, fed from Tableau
- The software platforms meet key criteria:
 - Ability to hold and process large data sets in time series, easily accept updates, and be versatile in use.
 - Accessibility of data to internal and external users, via export into common formats such as spreadsheet software, and directly on the platform without purchase of special tools.
 - Ability to restrict access to certain types or levels of data for certain groups of users.
 - Varied and high quality graphical and cartographical display must be provided, and the displays must be interactive with the data.
 - Stability as a dependable, tested tool.

Freight Sectors in the National Platform

Industry Sector1	National	Regional Expansion
Agriculture: Animal Products	11	
Agriculture: Dairy Products	9	
Manufacturing: Agricultural and Consumer Machinery	24	10
Manufacturing: Aircraft and Aerospace	5	
Manufacturing: Automotive	6	
Manufacturing: Beverages	5	
Manufacturing: Construction Machinery	23	
Manufacturing: Consumer and OEM Electronics	17	
Manufacturing: Food Products	6	
Manufacturing: Organic Chemicals (Plastics et al)	9	
Manufacturing: Paper Products	12	
Manufacturing: Pharmaceutical, Medical, and Consumer Products	45	5
Manufacturing: Recreational/Commercial Transport Equipment	17	5
Manufacturing: Speciality OEM Electronic Components	12	
Mining and Processing: Cement and Rock	20	
Mining and Processing: Coal	9	
Mining and Processing: Fertilizers	12	
Retail: Apparel Store	7	
Retail: Department Store	7	7
Retail: Grocery, Food, and Beverage	8	6
Retail: Home Improvement	7	5
Retail: Major National	4	
Retail: Personal Care Products	10	17
Transportation and Logistics	3	
Grand Total	288	55

- 24 companies provided “wiring diagrams” for 288 freight movement lanes by origin-destination zip code, commodity, mode, and logistics purpose
 - 12 = Manufacturing
 - 6 = Retail
 - 3 = Mining
 - 2 = Agriculture
 - 1 = Transportation

- Scalable
 - 55 “regional expansions” representing additional O-D moves for national supply chains – covering more dealers, retail outlets, etc. – in Chicago and NY/NJ regions
 - Plan to add more companies of regional interest

- Initially, four quarters of data for each data record
 - Data can be updated/maintained at moderate cost

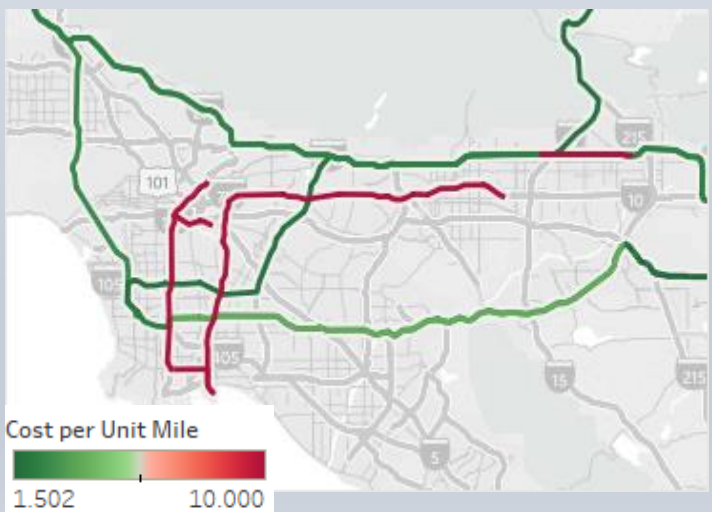
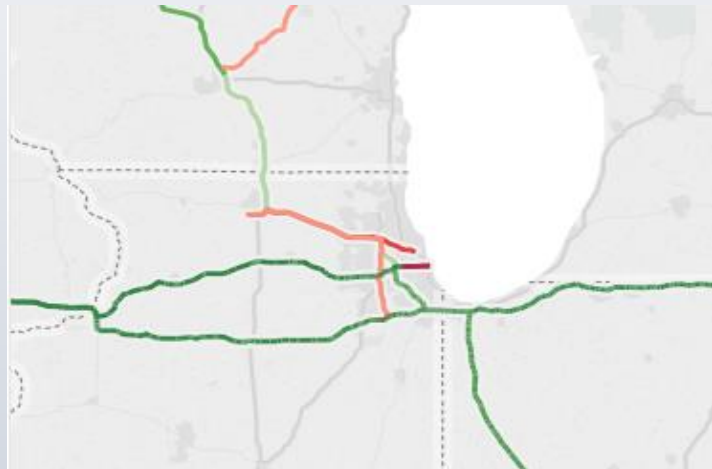
Truck Routes in the National Platform

24 National-Level Industry Sectors

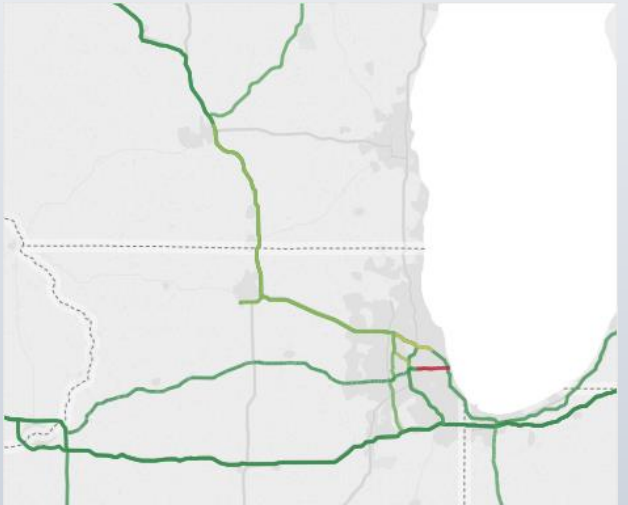


- Each record in the database has an assigned path
- GIS for each path will be included in the Tool – truck and non-truck
- Allows data attributes to be displayed at a path level in the Tool, in addition to table/chart summaries
- Links to FHWA/HOFM GIS tools for integration with other USDOT products
- Further expansion will allow gaps to be filled

Supply Chain Performance: Transportation Cost (US) and Truck Cost per NHS Mile (Regional) for 15 Sectors, Avg. Over 4 Quarters



Supply Chain Performance: Highway Planning Time Index (PTI) for 24 Sectors, Avg. Over 4 Quarters

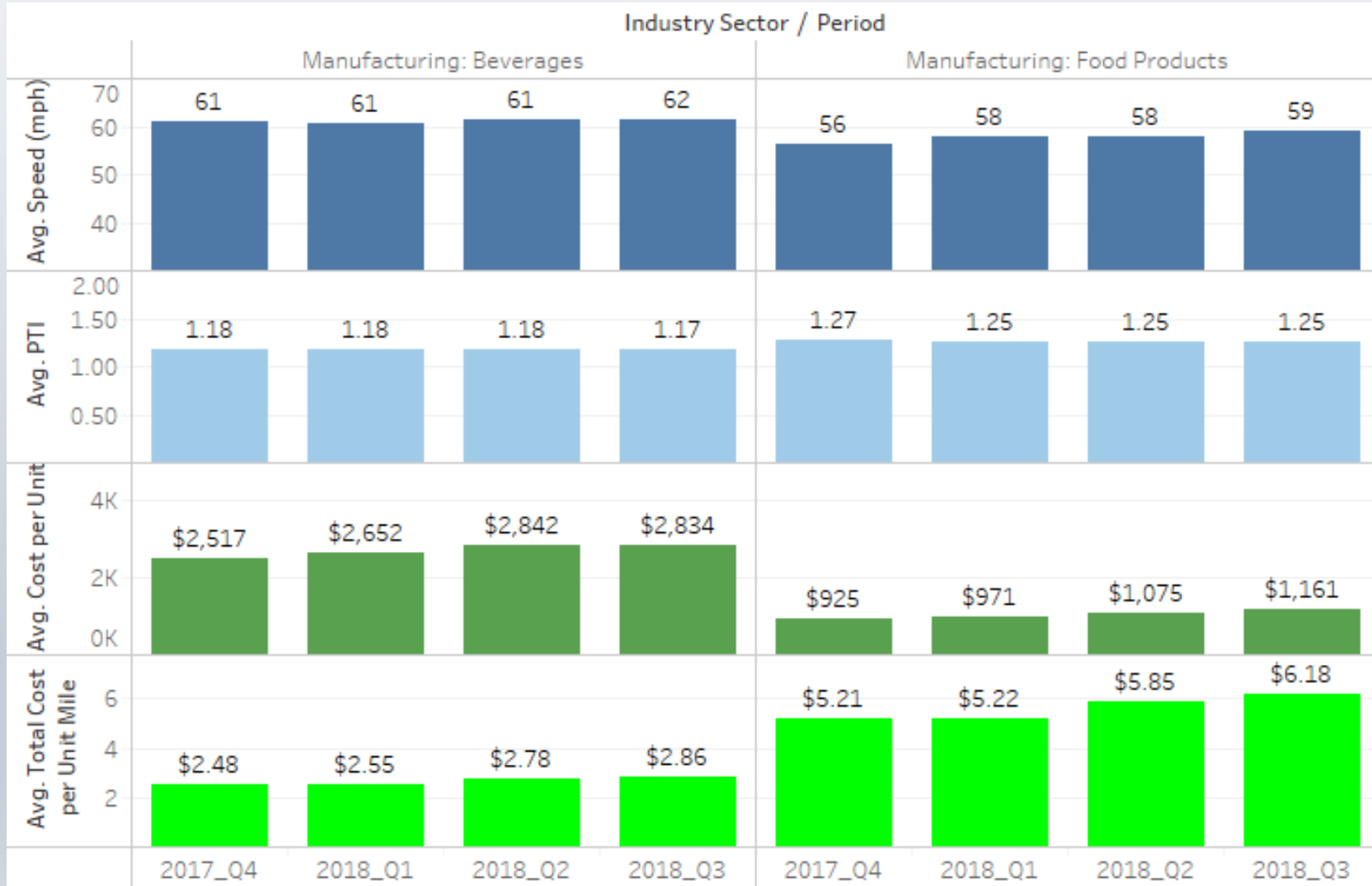


Supply Chain Performance: Changes in Highway PTI for 10 Sectors, 2017_Q4 to 2018_Q3



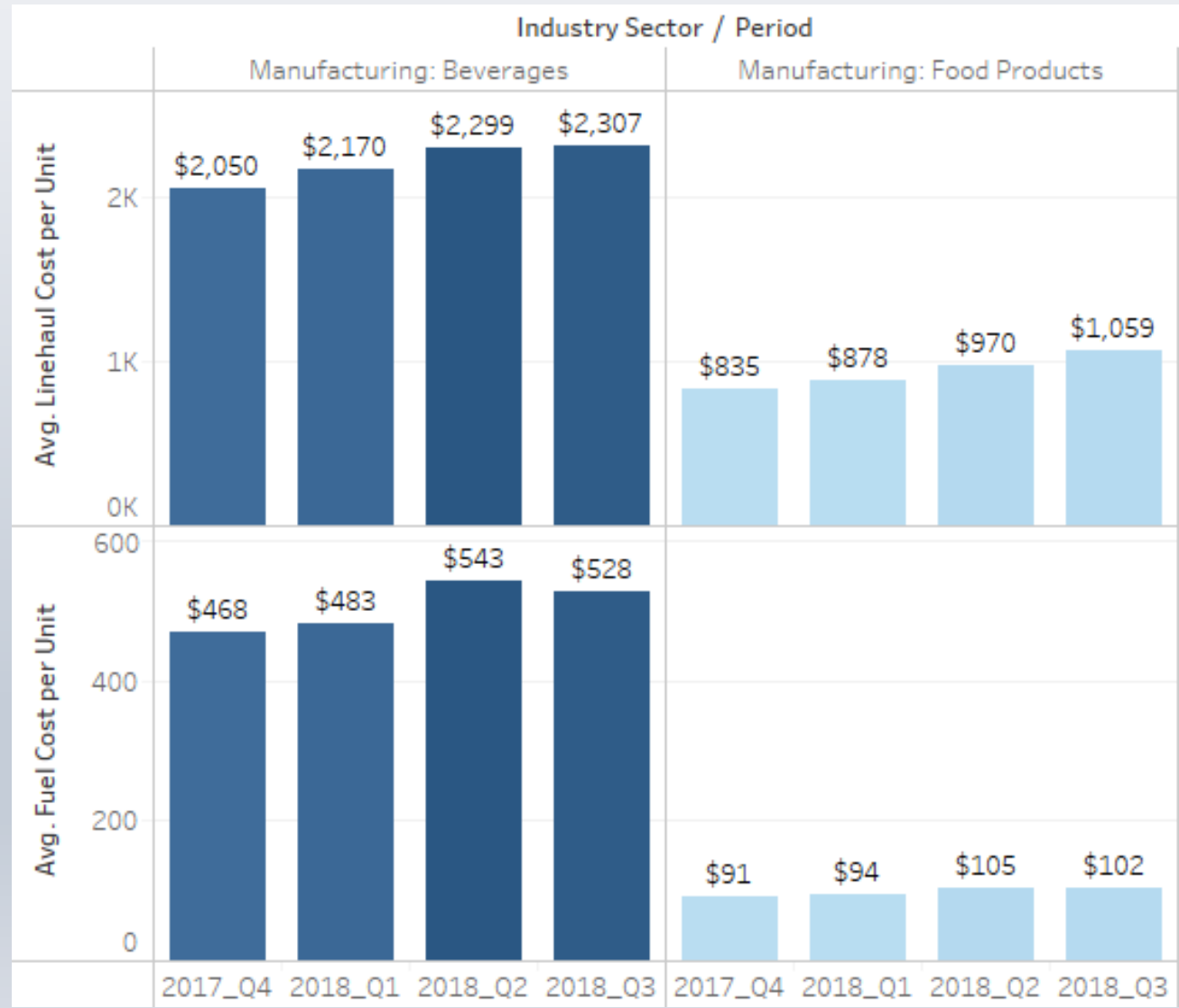
- With quarterly tracking, the data allows comparisons of PTI over different periods
- Between 2017 Q4 and 2018 Q3, some lanes saw better performance, some worse

Supply Chain Performance: Food/Beverage Manufacturing by Truck, Changes over 4 Quarters



- Changes in average speed, PTI, and cost per unit, as experienced by each industry sector
- Minor changes in average path miles each quarter based on NHS performance
- Food products are shorter hauls, more urban delivery, with lower speed and higher PTI; lower cost but higher cost per NHS mile
- Highway performance generally stable but costs generally rising

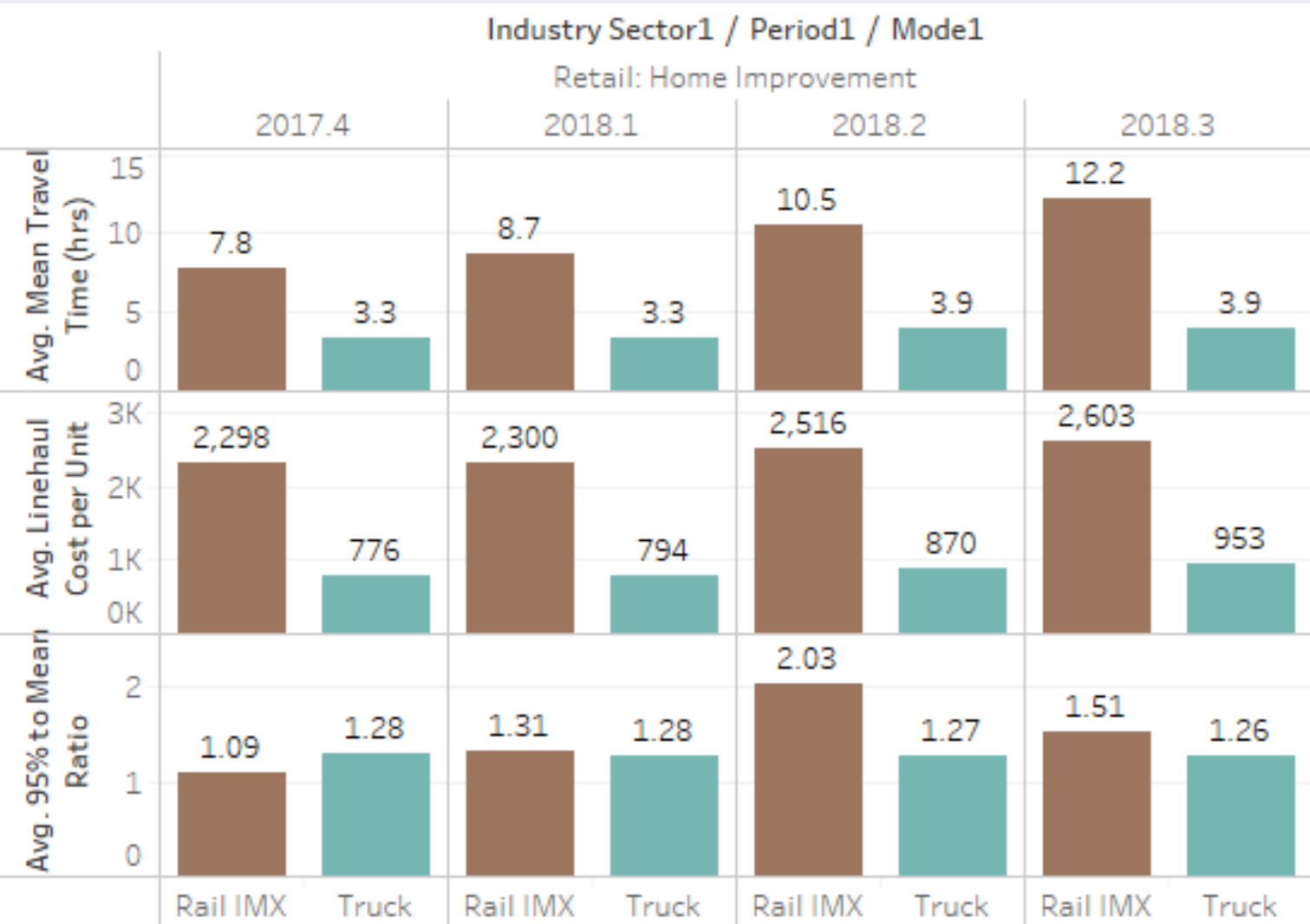
Supply Chain Performance: Trucking Cost Detail, Food/Bev Mfg



- For Food/Beverage Manufacturing, rising trucking costs are being driven by increases in both linehaul and fuel costs, but more by linehaul costs.
- For all sectors, trucking costs rose ~9% over analysis period, with largest percentage gains in the 100-399 and 400-999 mile groups. Local delivery and drayage costs (< 100 miles) were already very high, increased only slightly.

	Period	
NHS Zip Miles..	2017_Q4	2018_Q3
1 to 100	\$623	\$653
100 to 399	\$923	\$1,130
400 to 999	\$2,240	\$2,683
1000 or more	\$5,743	\$6,166
Grand Total	\$4,131	\$4,520

Supply Chain Performance: Comparison of Truck and Rail IMX over 4 Quarters, Retail Home Improvement



- Mean travel times for rail are longer (representing longer trips), and getting slower
- Truck and rail costs both rising
- Truck reliability is relatively constant but rail reliability is showing significant declines

Program Results

Makes supply chain patterns visible (*"If you can't measure it, you can't manage it...."*)

- Fills in the missing link in USDOT freight transportation data
- Makes supply chain performance visible across jurisdictions
- Provides foundation for state and metro/regional partners working on first/middle/last mile of national supply chains, and local/regional supply chains
- Puts DOTs and users on common ground

**Economy/
Markets**

**Logistics/
Operations**

**Networks/
Flows and
Infrastructure**

FHWA Freight Measurement Toolbox

- **Freight Analysis Framework (FAF)**
Economic output and growth by industry and region; commodity flows between regions by mode

- **Freight Fluidity Program (FFP)**
Travel time, travel-time reliability, and cost of representative supply chain freight trips

- **Highway Performance Monitoring System (HPMS)**
Condition and performance of the freight highway network
- **National Performance Management Research Data Set (NPMRDS)**
Vehicle speeds and travel times over the freight highway network
- **Rail Carload Waybill Sample (CWS)**
Volume and routing of freight flows over the freight rail network

FHWA Freight Fluidity: Next Steps

- Completing analysis
 - Costs for industries 16-24
 - Rail and water travel time and reliability
 - Obtaining additional industry recommendations from regional partners and collecting data
- Developing regional pilots and workshops:
 - Workshop dates: Chicago Regional – June 17 @ CMAP; NY/NJ Regional – June 27 @ NJTPA
 - Public Sector agency stakeholders – By invitation
- Preparing documentation with guidance: how to construct, how to use

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